

Remarks

I. Status of claims

Claims 47, 48, 50-55, and 57-66 were pending.

New dependent claims 67 and 68 have been added.

The Examiner has allowed claims 47, 48, 53-55, and 60. New claim 67 depends from allowed independent claim 47 and new claim 68 depends from allowed independent claim 54; therefore, claims 67 and 68 also should be in condition for allowance.

The Examiner has indicated that claims 51, 52, 58, 59, 62, and 64-66 would be allowable if rewritten in independent form.

II. Claim rejections under 35 U.S.C. § 102

The Examiner has rejected claims 50, 57, 61, and 63 under 35 U.S.C. § 102(e) over Beam (U.S. 2002/0150137).

In support of the rejection of independent claim 50, the Examiner has stated that (emphasis added):

With respect to claims 50 and 61, Beam discloses a VCSEL comprising: a first mirror stack (fig.2 #52), a second mirror stack (fig.2 #56), a cavity region disposed between the first mirror stack and the second mirror stack (fig.2 #20) and including an active region (fig.2 #26), a defect source (fig.2 #52/12, lattice mismatch starting at substrate continuing through DBR, also, DBR highly doped), a reliability-enhancing layer (REL) (fig.2 #54) positioned with respect to the defect source to reduce defect induced degradation of one or more VCSEL regions, wherein the reliability-enhancing layer is configured to at least in part balance strain created by the defect source ([0037], [0020]), the variation of the lattice constant through the buffer layer balances the strain problem that would occur due to the lattice mismatch between the substrate/DBR and the In containing active region, subsequently defects are reduced).

Thus, the Examiner's rejection of independent claim 50 is premised on (i) the assumption that the structure formed by the substrate 12 and the DBR 52 (referred to herein as the "substrate/DBR stack") constitutes a defect source that creates strain, and (ii) the

assumption that the metamorphic buffer layer 54 is configured to at least in part balance the strain that is presumed to be created by the substrate/DBR stack. These assumptions, however, are incorrect for the reasons explained below.

Contrary to the Examiner's first assumption, the Beam does not teach that the substrate/DBR stack creates strain. Indeed, the layers in the substrate 12 and the mirror stack 52 are alternating layers of GaAs and AlAs, which are lattice-matched.¹ Indeed, Beam explains that "Conventional DBR 52 includes an alternating sequence of GaAs layers (58a and 58b) and AlAs layers (60a and 60b) grown lattice-matched to GaAs substrate 12 ..." (¶ 34, lines 1-3). Therefore, the substrate/DBR stack does not create any appreciable strain and therefore does not constitute a defect source as defined in claim 50.

Contrary to the Examiner's second assumption, the metamorphic buffer layer 54 is not configured to at least in part balance the strain that the Examiner incorrectly has assumed is created by the substrate/DBR stack. First, as explained in the preceding paragraph, the substrate/DBR stack does not create any appreciable strain and therefore there is no strain to be balanced by the metamorphic buffer layer 54. Second, Beam teaches that there is no strain in the metamorphic buffer layer 54 and therefore, even assuming for the purpose of argument that the substrate/DBR stack creates a hypothetical strain, the metamorphic buffer layer 54 would not be able to balance that hypothetical strain.² In particular, Beam teaches that metamorphic buffer layer 54 "is substantially similar to metamorphic buffer layer 16" (¶ 37, lines 2-3). Beam additionally explains that "Strain in metamorphic buffer layer 16 resulting from its varying composition is relaxed by dislocations" (¶ 20, lines 6-7). Thus, Beam plainly teaches that there is no strain in the metamorphic buffer layer 54. Consequently, the metamorphic buffer layer 54 cannot possibly balance the non-existent strain that the Examiner incorrectly has assumed is created by the substrate DBR stack.

In the statement quoted above, the Examiner has reasoned that "the variation of the lattice constant through the buffer layer balances the strain problem that would occur due to the lattice mismatch between the substrate/DBR and the In containing active region"

¹ The lattice constant of AlAs is 5.6605 and the lattice constant of GaAs is 5.6533, resulting in a lattice mismatch of 0.1%.

² The Examiner and Mr. Garcia previously have agreed that in the context of claims 50 and 57 the ordinary and accustomed meaning of the term "balance" is to counterbalance or offset (see, e.g., Merriam-Webster's Collegiate Dictionary, 10th Ed.). The Examiner and Mr. Garcia also agreed that reducing strain effects in the active region 18 simply by increasing the distance between the oxidized control layer 20 and the active region 18 does not at least in part "balance" the strain created by the oxidized control layer 20 in accordance with the ordinary and accustomed meaning of the term. (See pages 7-8 of the Response filed June 1, 2006.)

(emphasis added). This reasoning, however, does not address the language of claim 50. In particular, claim 50 does not recite that the reliability-enhancing layer is configured to balance “the strain problem that would occur,” as assumed by the Examiner. Instead, claim 50 recites that “the reliability-enhancing layer is configured to at least in part balance strain created by the defect source.” That is, claim 50 requires that the reliability-enhancing layer at least in part balance actual strain that is created by the defect source, not some non-existence strain that would occur in some hypothetical VCSEL structure.

For at least these reasons, the Examiner's rejection of independent claim 50 under 35 U.S.C. § 102(e) over Beam should be withdrawn.

Claim 61 incorporates the features of independent claim 50 and therefore is patentable over Beam for at least the same reasons explained above.

Independent claim 57 recites features that essentially tracks the pertinent features of independent claim 50 explained above and, therefore, is patentable over Beam for at least the same reasons.

Claim 63 incorporates the features of independent claim 57 and therefore is patentable over Beam for at least the same reasons explained above.

III. Conclusion

For the reasons explained above, all of the pending claims are now in condition for allowance and should be allowed.

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Respectfully submitted,

Date: November 24, 2006


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